

Status of the Proton Source: Linac and Booster

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18 March 2003



Talk Outline



- # General comments.

- # Elliott.

 - *Update on the Linac (10 minutes).*

 - Including a sub-talk on the 7835 power amplifiers.

- # Eric.

 - *Update on the booster (45 minutes).*

General Comments



Linac + Booster = Proton Source

- *Commonality? Not much!*

Many Personnel Changes

- *Mostly in Booster,*
- *Reflects views of recent review committees*

MiniBooNE Campaign Goal!!

- *5.5×10^{16} protons delivered to the MiniBooNE target in 1 hour.*
 - 3.3×10^{12} ppp from Booster at >4 Hz
 - 6.9×10^{12} protons per pulse from Linac

Talk Outline: Linac



- # Recent Improvements and Performance.
- # Operational Limitations:
 - *Activation and Shielding issues.*
 - *Sub-talk: 7835 Power Amplifier Tubes in LEL.*
- # Plans & expectations for the next 8 months,
 - *Including July Shutdown.*

Improvements and Performance



Improvements

- *Linac 201 MHz Modulator “Switch Tube” inventory (61 tubes) tested*
 - One tube rebuilt successfully by Econco.
- *Upgrade of Linac water systems (200 MHz)*
 - Ongoing.
- *MuCool Construction Project (Popovic) flying along!*

Performance

- *The Proton Source does not limit Run II Operations*
 - But MiniBooNE demands lead to compromises
- *Current Linac performance*
 - 43-45 mA at up to 5 Hz
 - NTF operates 3 times/week

MuCool Construction Progress



December

Monday



18 March 2003

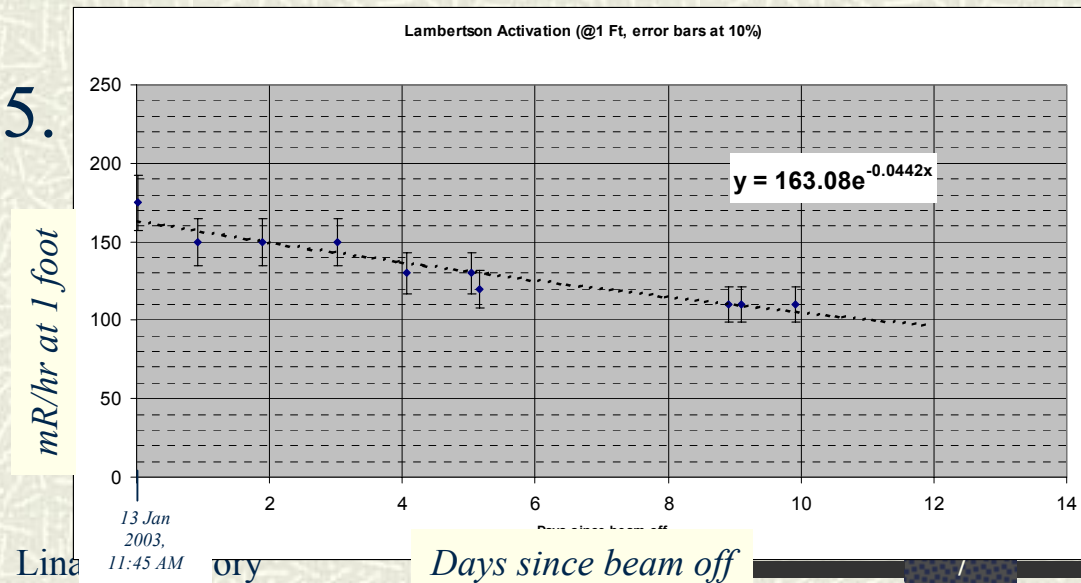
Operational Limitations



Losses & Activation.

- *In Linac, activation is noticeable, but not a limiting factor*
 - Tunnel shielding a problem at flux \rightarrow 5X higher
- *Activation decays, roughly, as $e^{-a t}$ [days]*
 - $0.03 < a < 0.05$
 - Half-life: 15-20 days

Sub-talk on the 7835.



18 March 2003

Linac

ory

Days since beam off

Sub-talk on the 7835



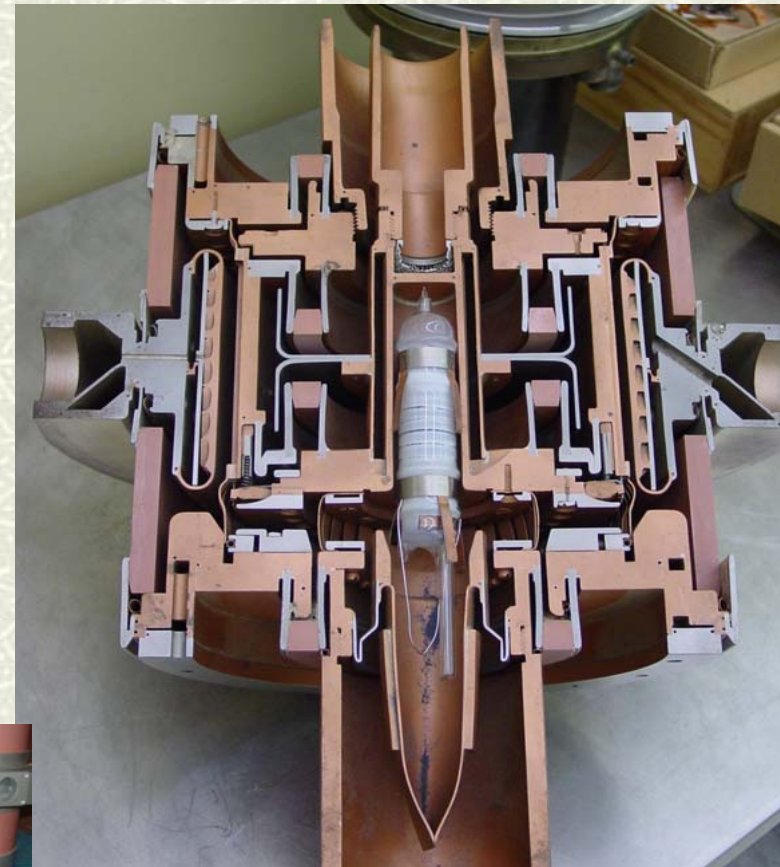
Our Power Amplifiers for the LEL are still in short supply!

- *Lack of spares has not affected operations, yet*
 - # of spares \approx Zero!
- *Four of last 12 tubes failed prematurely*
 - Expect/need 11,000 hours
 - Gotten: 2664, 5469, 6410, 7300 hrs

Outline of sub-talk:

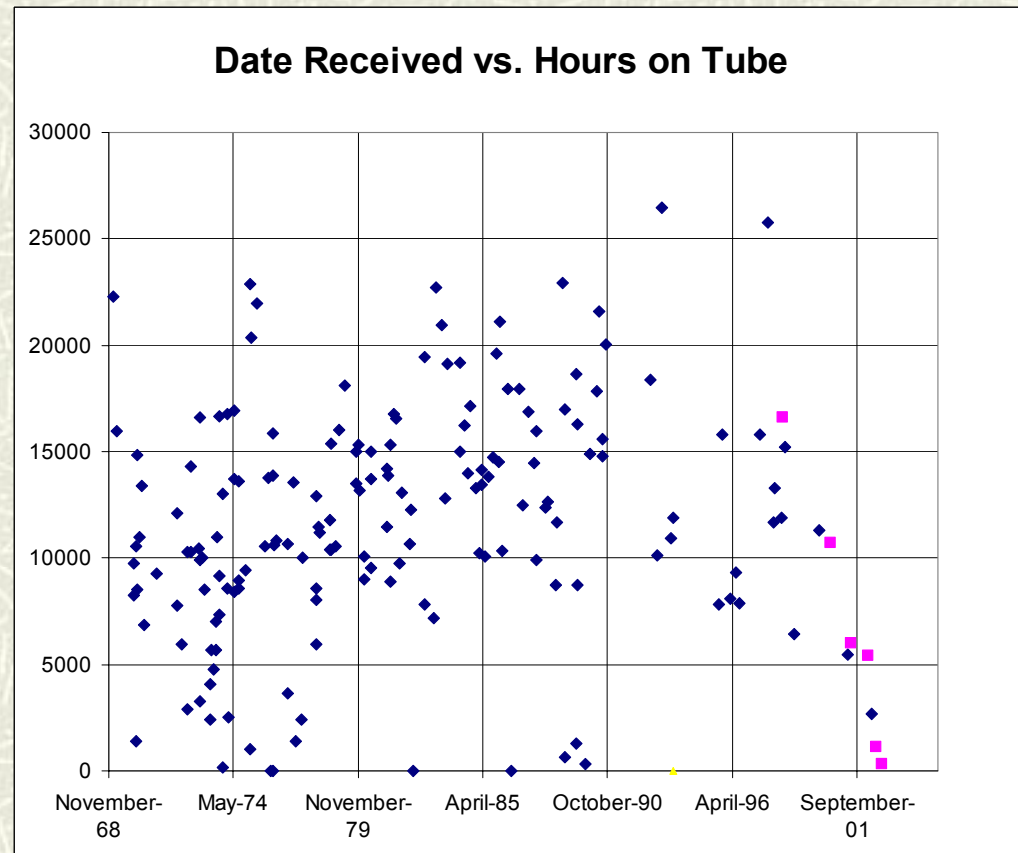
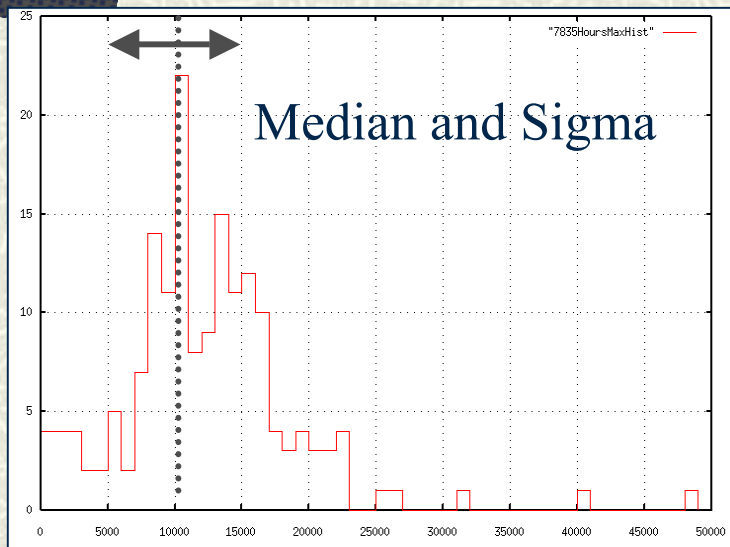
- *Pictures*
- *Histogram of Lifetimes*
- *Scatter plot of Lifetimes From Day 1*
- *Web Page of Tube Ages*
- *What Are We Doing?*
- *Who Else Uses Them?*
- *Alternatives?*

The RCA/Burle 7835



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7835 Lifetime Data



Web Page of Tube Ages



Hours on the Linac 7835 Power Amplifiers - Microsoft Internet Explorer

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Address <http://www-linac.fnal.gov/7835Hours.html>

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Hours on the Linac 7835 Power Amplifiers

Station	Tube S/N	Gradient	Filament A	Hours	Days	Fraction of median* life	Prob of failure this week
1	K7R2	1	6525	7438	309	0.47	0.014
2	A1R8	0.99	6644	1636	68	0.15	0
3	Y3R9	0.93	6831	3207	133	0.29	0
4	N14R6	0.98	6914	11814	492	1.09	0.028
5	Y2R7	1	6649	7367	306	0.68	0.014
7	none	-0.02	184	0	0	0	-

*Median lifetime for tubes is about 10750 hours (15750 for tank 1). This is 447 days (656 for tank 1).

Total probability of a 7835 failure this week: 0.056

Done Internet

7835s: What Are We Doing?



- # Burle is located in Lancaster, PA:
 - *I visited the facility last fall,*
 - *Czarapata is there today.*
- # We have borrowed two tubes:
 - *From Argonne (in LRF1).*
 - *From Brookhaven (in crate).*
 - *Have to repay both with “new” tube, someday.*
- # We have 17 tubes at Burle:
 - *2 New Tubes scheduled for delivery in April & June*
 - *8 of our duds in line for rebuild*
 - *Six on the schedule, two not scheduled (yet); Can be rebuilt up to 9 times.*
 - *7 ancient “Air Force” tubes*
 - *Probably cannot be rebuilt.*
- # ∴ 8 Tubes scheduled for delivery through August.
 - *“AZ4R1” scheduled for delivery next week.*

7835s: Who Else Uses Them?



- # Brookhaven:
 - *9 sockets, ~180days/year.*
- # Fermilab
 - *5 sockets, 365d/y.*
- # Los Alamos:
 - *5 sockets, ~180 d/y.*
- # Quadulan Islands (USAF in the South Pacific)
 - *4 sockets of 4617s, unknown duty factor.*
 - *Preempted by them recently.*
- # Argonne
 - *1 socket, a few days/year*

Where are the Quadulan Islands?



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[\[PPT\] Linac Issues](#)
File Format: Microsoft Powerpoint 97 - [View as HTML](#)
... BNL: 9 sockets. Argonne: 1 socket. **Quadulan Island** (military): 4 sockets.
Median Lifetime: 10750 Hours: This seems to be diminishing! ...
[bdps06.fnal.gov/ Linac%20Issues%20for%20DOE%20Review%20October%202002.ppt](#) - [Similar pages](#)

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NucNews February 8, 2000

7835s: Alternatives?



- # This is the only tube that can produce 5 MW peak power at 201 MHz.
 - *Several manufacturers have tried & failed,*
 - Including ITT and BNL.
 - *There are 3 MW tubes available,*
 - But would require, at least, 5 new RF systems.
 - *This is an alternative for Los Alamos.*
- # 402 MHz Klystrons & new \$40M LEL ☺

Plans in the Linac



For the next 8 months:

- *New Linac power amplifiers:*
 - 8 scheduled for delivery between now and August.
- *Installing some new loss monitors to determine directionality of losses.*

For the July Shutdown:

- *Install & commission new 400 MeV Lambertson magnet.*
- *Substantial upgrade to LEL water systems.*